

Amendment Dated 08/08/2005
Response to Office Action Dated 04/08/05

Application No. 10/085,172

REMARKS

With this Amendment, claims 1-5, 7-18, and 20-53 are pending with this paper. Claims 1-5 and 7-13 stand rejected. Claims 42-52 are withdrawn from consideration. The Applicant canceled claims 6 and 19 in the response to the Office Action dated August 26, 2004. The Applicant is adding claim 53.

The Applicant thanks the Examiner for withdrawing objections to the drawings.

The Applicant acknowledges the allowance of claims 14-18 and 20-41.

Election/Restrictions

The Office Action alleges that "Newly submitted claims 42-52 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: the claims are drawn to a frequency dependent embodiment." Claims 42-52 are withdrawn from consideration as being directed to a non-elected invention.

New Claim

The Applicant is adding claim 53, which is supported by the specification as originally filed (e.g., page 14, second paragraph).

Cited Prior Art

The Office Action depends on U.S. Patent No. 6,766,029 (Maisano), U.S. Patent Application Publication 2003/0142836 (Warren), and U.S. Patent No. 5,862,240 (Ohkubo) in the claim rejections.

Maisano discloses an acoustic beam former with at least two acoustical converters having a predetermined physical distance. The phase difference between A_1 and A_2 is $\Delta\phi$ as shown in Equation 10. The acoustic beam former multiplies $\Delta\phi$ by M , which is a function that may be a function of frequency ω . (Column 6, lines 7-55.) Consequently, the virtual distance is increased by a factor M as shown in Equations 11 and 12. Because the virtual distance is typically larger than the physical distance, lower frequencies may be utilized as shown in the equation at line 55. Lowering processing frequencies is advantageous for small acoustic devices, e.g., hearing aids.

Amendment Dated 08/08/2005
 Response to Office Action Dated 04/08/05

Application No. 10/085,172

Referring to FIG. 7, phase detecting unit 27 detects phase difference $\Delta\phi$, multiplier unit 28 multiplies $\Delta\phi$ by factor M, and phase shifter unit 29 phase shifts signal A_1 by phase difference signals provided by element 28. (Column 7, lines 9-13.) Consequently, the virtual distance between acoustical converters 2a and 2b is increased. Figure 8 shows a preferred embodiment of an inventive apparatus in a functional-block/signal flow representation in analogy to the representation of FIG. 7. (Column 7, lines 55-57.) Unit 33 provides a second order cardioid approximation, where unit 32 provides a first order cardioid approximation. (Column 8, lines 19-23.) The apparatus shown in FIG. 7 provides a first order cardioid approximation (A_1 from unit 23), while the apparatus shown in FIG. 8 provides a second order cardioid approximation (A_1 from unit 23'), in which both apparatuses increase the virtual distance between acoustical converters 2a and 2b by a factor M.

Warren discloses a directional microphone system for low passing filtering a first order signal, high pass filtering a second order signal, and summing the filtered signals. Referring the embodiment shown in FIG. 9, the disclosed apparatus combines three signals (a first signal corresponding to an omnidirectional pattern, a second signal corresponding to a dipole pattern, and a third signal corresponding to a quadrupole pattern). Warren discloses a dipole pattern in FIG. 4a and a quadrupole pattern in FIG. 5a. All the patterns shown in FIG. 4 and FIG. 5 have a main axis of 0 degrees.

Ohkubo discloses a microphone device that has a structure comprising at least three microphone elements disposed in the state spaced by predetermined distances in a direction perpendicular to the main axis of directivity, and an adder for adding output signals from the respective microphone elements.

Claim Rejections – 35 U.S.C. § 102

Claims 1, 3, 4, and 5 are rejected by the Office Action under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,766,029 (Maisano).

The Applicant has amended claim 1 to include “an algorithmic block producing a desired resulting output beam having a narrowed on-axis beamwidth, wherein the narrowed on-axis beamwidth of the desired resulting output beam is produced by superpositioning a desired main beam with a steerable beam steered at an angle from the axis of the desired main beam.” The

Amendment Dated 08/08/2005
Response to Office Action Dated 04/08/05

Application No. 10/085,172

Applicant has replaced "a beam steered at an angle from the axis of the desired main beam" with "a steerable beam steered at an angle from the axis of the desired main beam" to clarify the distinction of "a desired resulting output beam", "a desired main beam" and "a beam steered at an angle from the axis of the desired main beam".

The Office Action alleges that:

Maisano discloses a system comprising transducers 2a, 2b, beamformer 32 for producing a fixed input beam, and algorithmic block 33 for producing a narrowed on-axis beamwidth by superpositioning the fixed beam with the beam from transducer 2a phase shifted by shifter 29.

However, Maisano fails to teach or even suggest "an algorithmic block producing a desired resulting output beam having a narrowed on-axis beamwidth, wherein the narrowed on-axis beamwidth of the desired resulting output beam is produced by superpositioning a desired main beam with a **steerable beam steered at an angle from the axis of the desired main beam.**" (Emphasis added.) Referring to FIG. 8 of Maisano, Maisano merely discloses phase shifting the output of unit 32 by phase shifter unit 29' using phase difference signals from multiplier unit 28. The output of unit 32 is a signal having a first order cardoid pattern. Unit 33 combines the phase shifted signal from unit 29' and the output of unit 32. However, the apparatus disclosed in FIG. 8 cannot steer a beam (corresponding to the output of unit 32) because only one phase shift value is imposed on the output signal of unit 32 rather than individually imposing different phase shift values on each component signals from transducers 2a and 2b. (Different phase shift values must be imposed on different transducer elements spatially separated so that component signals do not cancel each other when the received signal is angularly offset to the perpendicular direction with respect to the transducer array.)

Moreover, because claims 3, 4, and 5 ultimately depend from claim 1, claims 3, 4, and 5 are not anticipated for at least the above reasons. The Applicant requests reconsideration of claims 1, 3, 4, and 5.

Claims 1-5 and 7-9 are rejected by the Office Action under 35 U.S.C. 102(e) as being anticipated by U.S. Patent Application Publication 2003/0142836 (Warren).

The Office Action alleges that:

Warren et al disclose a system in figure 9 comprising multiple beams (quadrupole,

Amendment Dated 08/08/2005
Response to Office Action Dated 04/08/05

Application No. 10/085,172

dipole), weights, and summation whereby the output signal has a narrow beamwidth.

However, Warren does not teach or even suggest "an algorithmic block producing a desired resulting output beam having a narrowed on-axis beamwidth, wherein the narrowed on-axis beamwidth of the desired resulting output beam is produced by superpositioning a desired main beam with a steerable beam steered at an angle from the axis of the desired main beam." (Emphasis added.) As disclosed in FIG. 9 of Warren, three signals are summed, where a first signal corresponds to an omnidirectional pattern, a second signal corresponds to a dipole pattern, and a third signal corresponds to a quadrupole pattern. As shown in FIGs. 4 and 5, each pattern is aligned along an axis corresponding to 0 degrees. Warren merely discloses combining component signals having in-line patterns rather than having patterns at an angle from the axis of the desired main beam. Warren fails to suggest a linear combination of steered beams. Moreover, Warren fails to even suggest steering any of the patterns of the component signals.

Because claims 1-5 and 7-9 ultimately depend from claim 1, claims 1-5 and 7-9 are not anticipated for at least the above reasons. The Applicant requests reconsideration of claims 1-5 and 7-9.

Claim Rejections – 35 U.S.C. § 103

Claims 10-13 are rejected by the Office Action under U.S.C. 103(a) as being unpatentable over Warren in view of US 5,862,240 (Ohkubo).

Claims 10-13 depend from claim 1. Moreover Ohkubo does not make up for deficiencies of Warren. Thus, claims 10-13 are patentable over Warren in view of Ohkubo. The Applicant requests reconsideration of claims 10-13.

Amendment Dated 08/08/2005
Response to Office Action Dated 04/08/05

Application No. 10/085,172

Conclusions

All objections and rejections have been addressed. Hence, it is respectfully submitted that the present application is in condition for allowance, and a notice to that effect is earnestly solicited.

Respectfully submitted,

Date: August 8, 2005

By: Kenneth F. Smolik

Kenneth F. Smolik
Registration No. 44,344
BANNER & WITCOFF, LTD.
10 South Wacker Drive
Suite 3000
Chicago, Illinois 60606
Telephone: 312-463-5000
Facsimile: 312-463-5001